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SOME SUB-SURFACE ROCK CHANNELS AND CAVITIES FILLED WITH GLACIAL MATERIAL.

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DESCRIPTION OF DEPOSITS.

At Silica, in Lucas County, Ohio, about ten miles west of Toledo, is a large quarry which shows a face about twenty feet in height and about one-fourth of a mile long, extending N-S. and facing east. The strata exposed are in the upper part of the Lucas dolomite and they dip westward at an angle of about five degrees.

Along the south part of this quarry face at about 15 feet beneath the top there was exposed in 1921 a zone of light drab dolomite, three to four feet thick, containing a number of cavities that are lined and partially filled with large crystals of calcite of the dog-tooth form. These spaces, or former spaces now partly filled, commonly appear as lense-shaped in the quarry face and are one to three feet long and six to twelve inches high.

Associated with the dolomite and calcite of this zone there is a considerable quantity of fine grained silt clay. Most of it is greenish or greenish-blue in color, but brown and other dark shades exist. Most of it is laminated, but some is compact without laminæ. It is very tough and when wet sticks to the hammer and tears like putty. When dry it is very hard and breaks with a direct even fracture. Most of this clay is without grit. At many places the clay rests against and fits around the projecting dog-tooth calcite crystals. It was found also in sharp lateral contact with the dolomite and even filling

small irregularities in the roofs of the former cavities. The clay exists in masses two to three feet across and in such quantity that in wet weather it causes considerable trouble in the crushing plant, because it clogs in the crushing burrs and prevents the rock from dropping into them. The larger masses are dumped to one side by the steam shovel and not loaded on the cars.

At several places sand is associated with the clay and at a few places there is gravel containing pebbles and cobbles, some of the latter being four to six inches through. The most common rock among the pebbles and cobbles is the Monroe dolomite, but basalts, granitoids and foreign sedimentaries exist. Some of the pebbles are well rounded and some are subangular. All of this material is relatively fresh. Most of the quarry face was a confused mass of blasted stone, but where the form of the clay deposits could be determined it was found that if gravel and sand exist they are at the bottom and at most places are overlaid by the clay. A few cases of very fine sand interbedded with clay exist. Surfaces of projecting dog-tooth calcite crystals are buried in the sand, which can be cleaned away from around the crystals.

One deposit in a tunnel in the rock gives such clear evidence as to deserve special notice. The rock channel is three feet six inches high and two feet wide at the widest part, and is cut across at an angle by the quarry wall. In the bottom is coarse gravel containing some cobbles up to six inches in diameter. Above the gravel is about two feet of compact, tough clay, blue in color, except for six inches at the top, which is oxidized and yellow. Above the clay is an open space about one foot high. The channel extends obliquely into the quarry wall and at a distance of about five feet it broadens out into a space four to five feet across, with about two feet above the filling of clay. Farther in, the channel narrows and the roof comes down until at a distance of about 20 feet from the quarry face there appears to be only four to six inches of space above the filling.

ORIGIN OF DEPOSITS.

As to the origin of the clay deposits, it is evident that they did not originate by weathering in place, but have been introduced in some way. The characteristics of the clay suggest

slack-water silt deposits such as are in many cases associated with glacial deposits. The composition and shape of the pebbles and cobbles and the amount of wear show that the gravel is glacial material. How did it come to its present position fifteen feet below the surface and apparently enclosed in the dolomite? The stone above is compact, bedded dolomite without any known natural opening through it. Numerous drill holes have been sunk for blasting the stone and some of these show on the quarry face, but the silt clay is very different from the calcareous slime derived by wash from the drillings and the packing used in the drill holes is distinct from the sand and gravel filling.

The characteristics of abundant calcite, cavities more or less filled with calcite, and the enclosed silt and gravel deposits, are present along the quarry face for more than a hundred yards; that is, these are characteristics of a zone. The strata here dip west into the quarry wall at an angle of about five degrees and if this zone is projected upward it would meet the level of the general rock surface about forty-five yards east of the present quarry wall. In fact, such a position of outcrop is shown at the south wall of the quarry. The cavernous character of this zone continued to the outcrop and it was by these openings that the glacial material entered. The first material carried down and deposited was sand and gravel with cobbles. The coarser material was deposited only in or near the more open channels like the one described above. Some of the sand was carried into the smaller crystal-lined cavities and deposited around the crystals.

The deposition of the clay followed that of the sand and gravel. Much of it is laminated and the material is very fine grained, indicating deposition from relatively quiet water which apparently filled all the cavities of the zone. The deposition continued until the cavities were completely filled, even to the placing of laminated clay in small irregularities in the roofs of the cavities. At other places the cavity filling was only partial or absent entirely.

The ground water level of the region at the present time is about 15 feet beneath the surface and it is evident that these cavities go deeper than this, and in another quarry this same zone contains much calcite filling, although few open spaces, at a depth of 45 feet. It is not known to what depth the

introduced glacial deposits extend, but their presence at 15 feet below the surface and the calcite filling at greater depth show that the region was higher and the ground water surface deeper at the time of the formation of the cavernous zone and probably at the time when the gravels were carried down the passages on a general five degree gradient. The clay on the other hand gives evidence that the channels were filled with water at the time of the clay deposition. This indicates a higher water table, or deposition at the time that the region lay beneath Lake Maumee and its successors. The general similarity of these clays to the clay deposits of the old lake bottom adds support to this latter interpretation. As the waters of the lake bottom at this place were agitated, the fine silt settled down into the water of the channels beneath, which were more or less connected with the lake, and in these channels and the connected rock cavities the clay deposition took place.

Two miles north of Silica a quarry, exposing the same horizons as at Silica, shows this same cavernous zone with crystal lined cavities. A fine grained clay was observed in the cavities at eight feet below the rock surface and a workman reported that they had found some very tough and sticky clay in the cavities of this zone at 15 feet below the rock surface. This clay is undoubtedly of the same type and origin as that at Silica.

Considerable masses of tough, fine grained clay were seen associated with the loose blocks of stone on the quarry faces at the Holland quarry, seven miles south of Silica and at the France Stone Company quarry, one mile south of Monroe, Michigan. The clay was much like that seen at Silica, but in neither of these places could it be so definitely connected with a glacial origin.

THE CLASSIFICATION OF PLANTS. XII.*

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Eleven papers have been published previously by the writer, giving a preliminary survey of the phyletic classification of plants, and covering the whole ground except the Algæ. The first paper was published in the OHIO NATURALIST, 5: 298-301, 1905, and subsequent papers appeared from time to time in that journal. The present paper completes the series, but it is the intention of the writer to continue the studies in a more detailed manner, dealing with the phylogeny and taxonomy of the various classes and subclasses.

The term Algæ has reference to a physiological group and is of the same convenience in dealing with the lower plants in a practical way as the terms, trees, parasites, herbs, etc. It has no taxonomic value. An alga may be defined as a thallophyte with chlorophyll. The algæ are largely aquatic organisms but some species are able to endure aerial conditions as their normal habitat.

The algæ apparently belong to at least six distinct phyla and a number of the classes have closely related fungi. Our knowledge of the morphology and life histories of the algæ is still very imperfect, so any arrangement must be regarded as more or less tentative. The writer has not been able to follow those authors who divide the green algæ primarily into Akontæ, Isokontæ, and Heterokontæ. Such a procedure seems decidedly artificial. The Peridinieæ are regarded as more animal-like than plant-like and are thus removed to the Protozoa. Following Oltmanns and others, the Diatomeæ are placed near the Conjugatæ but only as a subphylum, since the relationship can, at best, be only very remote. The agreement with desmids in certain characters is nevertheless striking and both diatoms and desmids may be regarded as derivatives from some primitive filamentous group without zoospores, but which discharged its isogamous sexual cells into the water with little change from the vegetative character. Although the Oedogoniales are

* Papers from the Department of Botany, The Ohio State University, No. 127.

peculiar in many respects they are nevertheless plainly related to the other filamentous green algæ and the same is true of the Siphoneæ and related forms which according to the writer's views do not warrant segregation into a distinct phylum as was done by Bessey. On the other hand, the Charales are so aberrant that their origin is very obscure and they have, therefore, been placed in a distinct phylum.

SYNOPSIS OF THE ALGAL PHYLA

I. Cells typically with poorly differentiated nuclei and chromatophores, reproducing by fission, motile and nonmotile, never with a pure chlorophyll-green color, but containing phycocyanin; unicellular or filamentous, apparently without sexuality. The most primitive of the algae and along with the bacteria the most primitive of all organisms. Marine or mostly freshwater, some species growing in very hot springs. Phylum, SCHIZOPHYTA.

II. Cells with well differentiated nuclei and usually with definite chromatophores; green or variously tinted by coloring matters.

A. Unicellular or filamentous plants containing chlorophyll, either of a brownish or yellowish color and with silicified, two-valved walls, or green with complex chromatophores or fantastic cells, the walls not silicified; sexual or apparently nonsexual by degeneration; conjugating cells not ciliated, isogamous. Phylum, ZYGOPHYTA.

1. With silicified, valved cell walls, usually with fantastic forms and markings, and usually of a yellowish or brownish color. Marine and fresh water plants. Subphylum, DIATOMEAE.
2. Cell walls not silicified; plants filamentous or unicellular, green, the unicellular often with fantastic forms and markings. Fresh water plants. Subphylum, CONJUGATAE.

B. Plants not with silicified two-valved walls; usually with zoospores when green, or with heterogamous sexuality, sometimes nonsexual, the isogamous green forms usually not with fantastic chromatophores nor with a constriction in the middle of the cell.

1. Antheridium when present not consisting of a globular structure containing sperm-bearing filaments; sometimes with an alternation of generations.
   a. Plants mostly green, nearly all producing nonsexual zoospores, the sexual forms isogamous or heterogamous. Characteristic water plants, but also numerous marine species. Phylum, GONIDIOPHYTA.
   b. Plants with the chlorophyll usually hidden by a brown, red, or purple pigment always with a multicellular body and with sexuality or apparently from sexual ancestors.
      (a) Mostly marine, often large, brown algae with phycophaein; isogamous or heterogamous or sexuality unknown, with ciliated sperms, both gametes discharged from the gametangium. Phylum, PHAEOPHYTA.
      (b) Mostly marine red or purple algae with phycoerythrin; heterogamous, with stationary eggs and non-ciliated sperms. Phylum, RHODOPHYTA.
2. Filamentous, green algae with globular antheridia containing sperm-bearing filaments, the sperms being biciliated; nonsexual spores absent. In fresh or brackish water. Phylum, Charophyta.

SYNOPSES OF THE SEVERAL PHYLA

Phylum, SCHIZOPHYTA. Fission Plants.

I. Without a definite nuclear membrane and with a low type of chromatophore. Class, CYANOPHYCEAE. Blue-green Algae. 1000 species.

A. Not filamentous; cells free or in masses or plates (superficial aggregates); or the cell individuals with definite base and apex, in fruiting sometimes forming a row of cells. **Chroococcales.** Chroococcaceae, Chamaesiphonaceae.

B. Cells arranged in definite filaments.

1. Filaments without hair-like tips, sometimes narrowed at the ends.
   a. Without heterocysts; free filaments commonly massed into flat layers, sometimes several filaments enclosed in one common sheath. **Oscillatoriales,** Oscillatoriaceæ.
   b. With intercallary heterocysts. **Nostocales.** Nostocaceæ, Scytonemataceæ, Stigonemataceæ.
2. Filaments with hair-like tips at one or both ends. **Rivulariales.** Camptotrichaceæ, Rivulariaceæ.

II. With nuclear membrane and highly differentiated chromatophores; unicellular or in colonies. Class, GLAUCOCYSTEÆ. 20 species. **Glaucocystales,** Glaucocystaceæ.

Phylum, ZYGOPHYTA. Conjugate Algæ.

I. Cell walls impregnated with silica, composed of two valves; chromatophores yellow or brown, rarely green, containing chloraphyll and diatomin and a variable number of pyrenoids. Subphylum and class, DIATOMEÆ. Diatoms. 5700 species.

A. Valves without a raphe or pseudo-raphe, with a concentric or ratiating symmetry around a central point; valve view usually circular, polygonal, or broadly elliptical in outline, rarely boat-shaped or irregular; conjugation unknown; cells without spontaneous movement. Mostly marine plants. **Eupodiscales.** Round Diatoms. Eupodiscaceæ, Soleniaceæ, Biddulphiaceæ, Rutilariaceæ.

B. Valves with a raphe or pseudo-raphe or with a sagittal line, with a zygomorphic or isobilateral or sometimes irregular symmetry; never centric; valve view mostly boat-shaped or elliptic in outline; motile or nonmotile; conjugation known in most groups. Mostly fresh water plants. **Naviculales.** Long Diatoms. Fragillariaceæ, Surirellaceæ, Achnanthaceæ, Naviculaceæ.

II. Cell walls without silica, but with abundant development of gelatinous pectose causing the plants to be slimy to the touch; chromatophores green, with chlorophyll and one or more pyrenoids. Subphylum and class CONJUGATÆ. 2300 species.

A. Thallus a filament, or commonly separating into single cells, mostly flattened, the cell wall usually divided into two symmetrical halves; cells mostly constricted at the middle, often of fantastic and beautiful forms; cell contents mostly divided into symmetrical halves; conjugation by the breaking open of the cell walls or by the formation of a primitive conjugation tube. **Desmidiales.** Desmids. 2100 species. Spirotaeniaceæ, Desmidiaceæ.

B. Thallus a simple filament, occasionally slightly branched, of cylindrical cells, the cells not constricted in the middle, but sometimes the contents divided into symmetrical halves; these latter forms distinguished from the preceding order by the definite filament and prominent conjugation tube; some species forming aplanospores. **Zygnemales.** Pond-scums. 200 species. One family, Zygnemaceæ.

Phylum, GONIDIOPHYTA. Zoospore Plants.

SYNOPSIS OF THE CLASSES OF GONIDIOPHYTA.

I. Plants unicellular or colonial, not truly filamentous.
   A. Nonsexual, unicellular or colonial algæ without zoospores, commonly with autospores; cells normally with one nucleus. AUTOSPORÆ.
   B. Isogamous or heterogamous, sexual algæ or probable derivatives from them, with zoospores.
      1. Unicellular or colonial algæ, usually with one nucleus in each cell, rarely cenocytic; the colonial forms not produced by the symmetrical aggregation of free zoospores into a definite colony; vegetative stage nonmotile or active. Isogamus or heterogamous. CHLOROCOCCEÆ.
      2. Cenocytic algæ consisting of colonies of peculiar form, new colonies being produced by the definite arrangement of daughter cells developed in the parent cenocyte; isogamous, aquatic. HYDRODICTYEÆ.

II. Green algæ with a filamentous or massive body and with 1, 2, 4, or many cilia on the zoospores and gametes.
   A. Cenocytic, septate or nonseptate, isogamous or heterogamous.
      1. Vegetative body usually septate, consisting of a series of cenocytes; chloroplasts forming a net, rarely in separate plates. SIPHONOCLADEÆ.
      2. Vegetative body usually nonseptate, with distinct lenticular, oval or plate-like chloroplasts. SIPHONEÆ.
   B. Algæ having normal cells with one nucleus, with a conjugation of free swimming gametes or with motile sperms and stationary eggs. CONFERVEÆ.

Class, AUTOSPORÆ. 200 species.

I. Reproduction by autospores, the protoplast dividing within the mother cell, and the daughter cells escaping singly or in colonies. In fresh, brackish, or sea water, or on moist rocks, etc.; some endozoic in water animals. **Selenastrales.** Selenastraceæ, Oocystaceæ, Chlorellaceæ, Tetraedraceæ, Scenedesmaceæ, Sorastraceæ.

II. Reproduction by vegetative division and separation by splitting of the daughter cells. (Doubtfully placed in the Autosporæ). Aerial, on damp stones, trees, etc., or in fresh or salt water. **Protococcales.** Protococcaceæ.

Class, CHLOROCOCCEÆ. 250 species.

I. Cells ciliated and motile in the vegetative state; unicellular or in definite colonies. **Volvocales.** Chlamydomonadaceæ, Volvocaceæ.

II. Cells not active in the vegetative stage.
   A. Vegetative cell divisions absent, cells separate or somewhat cenocytic. **Chlorococcales.** Chlorococcaceæ, Chloretheciaceæ, Ophiocytiaceæ.
   B. Colonies increasing by vegetative cell division. **Tetrasporales.** Botryococcaceæ, Tetrasporaceæ.

Class, HYDRODICTYEÆ. 30 species.

One order, **Hydrodictyales.** Pediastraceæ, Hydrodictyaceæ.

Class, SIPHONOCLADEÆ. Lower Tube Algæ. 450 species.

I. Plants isogamous or slightly heterogamous; filaments branched. **Cladophorales.** Valoniaceæ, Cladophoraceæ, Siphonocladaceæ, Dasycladaceæ.

II. Plants heterogamous, with stationary eggs and motile spermatozoids; filaments septate, unbranched, free-floating. **Sphaeropleales.** Sphaeropleaceæ.

Class, SIPHONEÆ. Higher Tube Algæ. 200 species.

I. Sexual reproduction unknown or isogamous.
  A. Small globular terrestrial plants with branched rhizoids penetrating the ground; zoospores with cilia of unequal lengths. **Botrydiales.** Botrydiaceæ.
  B. Mostly large marine or sometimes endophytic algæ; zoospores if present not with unequal cilia. **Bryopsidales.** Derbesiaceæ, Bryopsidaceæ, Caulerpaceæ, Phyllosiphonaceæ, Codiaceæ.

II. Sexual reproduction by highly specialized stationary eggs and motile spermatozoids; thallus tubular, branched or unbranched; growing in fresh or brackish water or on moist soil. **Vaucheriales.** Vaucheriaceæ.

Class, CONFERVEÆ. Confervas. 650 species.

I. Isogamous, or the free-swimming gametes sometimes of unequal size.
  A. Thallus unbranched.
    1. Chloroplasts reticulate, without pyrenoids; fresh water plants. **Microsporales.** Microsporaceæ.
    2. Chloroplasts central or parietal, with one or more pyrenoids.
      a. Chloroplast single, central, stellate, with one pyrenoid; no zoospores known; aerial in habit. **Prasiolales.** Prasiolaceæ.
      b. Chloroplast parietal, with one to many pyrenoids.
        (a) Unbranched filaments; chloroplasts with one to many pyrenoids. **Ulotrichales.** Ulotrichaceæ, Tribonemaceæ.
        (b) Thallus expanded, a 1-2-layered plane or tube; chloroplast single, with 1 pyrenoid; mostly marine. **Ulvales.** Ulvaceæ.
  B. Thallus filamentous, branched, usually abundantly so, the branches often attenuated or hair-like tips. **Chaetophorales.** Chaetophoraceæ, Trentepohliaceæ, Harposteiraceæ.

II. Heterogamous, the egg stationary in the oogonium; sometimes with a primitive alternation of generations.
  A. Oogonium not developing a cortical layer after fertilization. **Oedogoniales.** Cylindrocapsaceæ, Oedogoniaceæ.
  B. Oogonium with a trichogyne-like tip, covered after fertilization by a cortical layer; thallus disk-like or cushion-like. **Coleochaetales.** Coleochaetaceæ.

Phylum, PHAEOPHYTA. Brown Algæ.

I. Zoospores present; sexual reproduction by motile, biciliate gametes produced in external gametangia, occasionally by heterogametes, and in extreme cases by nonmotile eggs. Class, PHAEOSPORÆ. Kelps. 550 species.
  A. Zoospores and isogametes similar and motile.
    1. Frond various, simple or branched, but never differentiated with definite root-like and leaf-like parts. **Ectocarpales.** Ectocarpaceæ.
    2. Frond large, leather-like, usually stalked, differentiated with root-like and leaf-like parts; with zoospores only. The largest marine plants. **Laminariales.** Laminariaceæ. Giant Kelps.
  B. Zoospores and heterogametes dissimilar.
    1. Gametes large and small, but both motile. **Cutleriales.** Cutleriaceæ.
    2. Gametes consisting of small active spermatozoids and nonmotile eggs; frond filiform. **Tilopteridales.** Tilopteridaceæ.

II. Zoospores absent; sexual reproduction by means of motile sperms and nonmotile eggs which are discharged from the oogonium; nonsexual reproduction absent or by means of nonmotile spores.
  A. Sperms biciliate; without nonsexual spores; gametangia in sunken conceptacles. Class, CYCLOSPORÆ. Rockweeds. 350 species. One order **Fucales.** Durvillaeaceæ, Himanthaliaceæ, Fucaceæ, Sargassaceæ.
  B. Sperms with one flagellum; nonsexual spores nonmotile; reproductive organs external; with a regular alternation of sexual and nonsexual generations. Class, DICTYOTEÆ. 130 species. One Order, **Dictyotales.** Dictyotaceæ.

Phylum, RHODOPHYTA. Red Algæ.

I. Nonsexual reproduction by single thallus cells; trichogyne imperfectly developed; no pits between the thallus cells. Class, MONOSPORÆ. 50 species. One order, **Bangiales.** Bangiaceæ, Rhodochaetaceæ, Compsopogonaceæ.

II. Nonsexual reproduction by tetraspores usually developed in groups of four; trichogyne well developed; cells protoplasmically connected through large pits in the walls. Class, FLORIDEÆ. 3000 species.

A. Sporophores ("gonimoblasts" or branches bearing the carpospores) of the sporocarp produced directly from the fertilized oogonium; mostly plants with filiform fronds. Fresh water or marine. **Nemalionales.** Lemaneaceæ, Helminthocladiaceæ, Chaetangiaceæ, Gelidiaceæ.

B. Sporophores produced by auxiliary cells after these conjugate with the fertilized oogonia or their branching processes ("ooblastema").

1. Sporophores produced by nearby auxiliary cells; marine plants.

a. Sporophores produced by nearby auxiliary cells and growing outward in the plant body; filiform, foliaceous or massive plants. **Rhodymeniales.** Sphaerococcaceæ, Rhodymeniaceæ, Delesseriaceæ, Bonnemaisoniaceæ, Rhodomelaceæ, Ceramiaceæ.

b. Sporophores produced by the nearby auxiliary cells and branching copiously in the surrounding tissues of the plant body; fronds parenchymatous, flattened or leaf-like. **Gigartinales.** Acrotylaceæ, Gigartinaceæ, Rhodophyllidaceæ.

2. Sporophores produced by remote auxiliary cells after these have conjugated with the branched "ooblastema" filaments arising from the fertilized oogonium; fronds filiform, branched, often flattened. Mostly marine, but a few fresh water species. **Cryptonemiales.** Gloiosiphoniaceæ, Grateloupiaceæ, Dumontiaceæ, Nemastomaceæ. Rhizophyllidaceæ, Squamariaceæ, Corallinaceæ.

Phylum, CHAROPHYTA. Stoneworts.

One class and one order, CHAREÆ. 160 species. **Charales.**

I. Crown of the oogonium with ten cells. Nitellaceæ.
II. Crown of the oogonium with five cells. Characeæ.

KEY TO THF ORDERS OF ALGÆ

1. Nonsexual fission algæ, unicellular, colonial or filamentous, blue-green or brownish, never with a pure chlorophyll-green color, usually with gelatinous walls; filaments often with heterocysts; never with cilia or flagella, but sometimes motile; chromotophores usually poorly defined. 2.
1. Mostly sexual algæ, but sometimes nonsexual, with a pure chlorophyll-green color or often red, purple, yellow, or brown; plants not propagating by fission; unicellular, colonial, filamentous, or massive; chloroplasts usually well defined; commonly with zoospores; some with silicious walls. 6.
2. With poorly differentiated nuclei, without a definite nuclear membrane, and with a low type of chromatophore. (CYANOPHYCEÆ). 3.
2. With well developed nuclei, with a nuclear membrane, and with highly differentiated chromatophores. (GLAUCOCYSTEÆ). **Glaucocystales.**
3. Not filamentous; unicellular or colonial, free or attached. **Chroococcales.**
3. Cells arranged in definite filaments. 4.
4. Filaments without hair-like tips, sometimes narrowed at the ends. 5.
4. Filaments with hair-like tips at one or both ends, with or without heterocysts. **Rivulariales.**
5. Without heterocysts. **Oscillatoriales.**
5. With heterocysts. **Nostocales.**
6. Cells covered with two silicious, usually ornamental valves, mostly brown or yellowish in color; unicellular, or simple filaments, sometimes on gelatinous stalks. (DIATOMEÆ). 7.
6. Cells not covered with two silicious valves. 8.

7. Valves without a raphe or pseudo-raphe; usually with a concentric or radiating symmetry around a central point, rarely isobilateral or zygomorphic; valve view usually circular; polygonal, or broadly elliptical in outline. **Eupodiscales.**
7. Valves with a raphe or pseudo-raphe, or with a sagittal line; with an isobilateral or zygomorphic symmetry, never centric; valve view mostly boat-shaped, needle-shaped, rod-shaped, or elliptic in outline. **Naviculales.**
8. Unicellular or simple free filaments, chlorophyll-green, with complex chromatophores containing prominent pyrenoids, reproduction usually by conjugation of the cell contents either through a conjugation tube or by the breaking open of the cell walls; cells and gametes never with cilia; unicellular forms usually of fantastic shapes, usually divided into two symmetrical halves. (CONJUGATÆ). 9.
8. Sexual process if present by typical isogametes, or heterogamous; plants commonly branched filaments or massive, the unicellular forms or simple filaments rarely corresponding to the above description. 10.
9. Thallus a filament or mostly unicellular, the cell wall usually divided into two symmetrical halves, cells mostly constricted at the middle; conjugation by the breaking open of the cell walls or by the formation of a primitive conjugation tube. **Desmidiales.**
9. Thallus a simple filament of cylindrical cells not constricted in the middle, but sometimes the contents divided into symmetrical halves; these latter forms distinguished from the preceding order by the definite filament and the prominent conjugation tube. **Zygnemales.**
10. Antheridia when present not consisting of a globular structure containing sperm-bearing filaments. 11.
10. Filamentous green algæ with globular antheridia containing sperm-bearing filaments, erect, branches in whorls; rhizoids thread-like; sperms biciliate, non-sexual spores absent; plants more or less incrusted with lime. (CHAREÆ). **Charales.**

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11. Plants green, rarely with a red or brown color and then unicellular; nearly all producing zoospores except the lowest; largely fresh water algæ, but some marine. 12.
11. Plants usually with the chlorophyll hidden by a brown, red, or purple pigment, always with a multicellular body, often massive; sperms motile or non-motile; mostly marine algæ. 29.
12. Plants unicellular or colonial, not truly filamentous. 13.
12. Plants filamentous or massive. 18.
13. Nonsexual unicellular or colonial algæ without zoospores, commonly with autospores or merely splitting apart; cells normally with one nucleus, not forming net-like or fantastic, radially symmetrical plate-like union colonies (AUTOSPORÆ). 14.
13. Isogamous or heterogamous sexual algæ usually with zoospores. 15.
14. Reproduction by autospores, the protoplast dividing within the mother cell and the daughter cells escaping singly or in colonies. **Selenastrales.**
14. Reproduction by vegetative division and separation by the splitting apart of the daughter cells. **Protococcales.**
15. Unicellular or colonial algæ with cells normally having one nucleus; the colonial forms not produced by the symmetrical aggregation of free zoospores. (CHLOROCOCCEÆ). 16.
15. Cenocytic algæ consisting of net-like or symmetrical plate-like colonies of peculiar form, produced by the definite arrangement and union of daughter cells in the parent cenocyte; (HYDRODICTYEÆ). **Hydrodictyales.**
16. Cells ciliated and active in the vegetative state; unicellular or in definite colonies, commonly spherical. **Volvocales.**
16. Cells not active in the vegetative stage. 17.
17. Vegetative cell division absent, cells separate or somewhat cenocytic. **Chlorococcales.**
17. Colonies increasing by vegetative division. **Tetrasporales.**

18. Cenocytic algæ, septate or nonseptate. 19.
18. Not cenocytic, but with normal cells having a single nucleus. (CONFERVEÆ). 23.
19. Vegetative body usually septate, consisting of a series of cenocytes; chloroplasts forming a net, rarely in separate plates. (SIPHONOCLADEÆ). 20.
19. Vegetative body usually nonseptate, with distinct lenticular, oval, or plate-like chloroplasts. (SIPHONEÆ). 21.
20. Filaments branched; plants isogamous. **Cladophorales.**
20. Filaments unbranched, free-floating; plants heterogamous with stationary eggs. **Sphaeropleales.**
21. Isogamous, or sexual reproduction unknown. 22.
21. Sexual reproduction by highly specialized stationary eggs and motile spermatozoids; thallus tubular, branched or unbranched. **Vaucheriales.**
22. Small globular terrestrial plants with branched rhizoids penetrating the ground; zoospores with cilia of unequal lengths or with only one. **Botrydiales.**
22. Mostly large marine or sometimes endophytic algæ; zoospores if present otherwise. **Bryopsidales.**
23. Isogamous, or the free-swimming gametes of unequal size. 24.
23. Heterogamous, the egg stationary in the oogonium; oogonium developing a cortical layer after fertilization, or if not then certain cells of the filament with peculiar striate rings around the top. 28.
24. Thallus unbranched. 25.
24. Thallus filamentous, branched, usually abundantly so, the branches often with hair-like attenuated tips. **Chaetophorales.**
25. Chloroplasts reticulate, without pyrenoids; growing in fresh water. **Microsporales.**
25. Chloroplasts central or parietal, with one or more pyrenoids. 26.
26. Chloroplast single, central, stellate, with one pyrenoid; no zoospores known; aerial in habit. **Prasiolales.**
26. Chloroplasts parietal with one to many pyrenoids. 27.
27. Unbranched filaments; chloroplasts with one to many pyrenoids. **Ulotrichales.**
27. Thallus expanded, a 1-2-layered lamina or tube; chloroplast single with one pyrenoid; mostly marine plants. **Ulvales.**
28. Oogonium not developing a cortical layer after fertilization; zoospores with a crown of cilia; certain cells with striate rings at the upper end. **Oedogoniales.**
28. Oogonium with a trichogyne-like tip, covered after fertilization by a cortical layer; thallus disk-like or cushion-like; zoospores biciliate. **Coleochaetales.**

—29—

29. Mostly marine brown algæ; isogamous or with ciliated sperms, and large eggs, both gametes discharged from the gametangia; or with zoospores only. 30.
29. Mostly marine red algæ, with stationary eggs and non-ciliated sperms; mostly with tetraspores; zoospores absent; usually with cystocarps. 35.
30. Zoospores present; sexual reproduction by motile biciliate gametes produced in external gametangia; occasionally heterogamous, the extreme cases with non-motile eggs. (PHAEOSPORÆ). 31.
30. Zoospores absent; sexual reproduction by means of motile sperms and non-motile eggs which are discharged from the oogonium; gametangia sunken or external; non-sexual reproduction absent or by means of nonmotile spores. 34.
31. Zoospores and isogametes similar and motile. 32.
31. Zoospores and heterogametes dissimilar. 33.
32. Frond various, simple or branched, but never differentiated with definite root-like and leaf-like parts. **Ectocarpales.**
32. Frond large, leather-like, usually stalked, differentiated with root-like and leaf-like parts; with zoospores only; plants usually very large. **Laminariales.**
33. Gametes large and small but both motile; plants medium to large, flat, branched, or orbicular, attached by rhizoids. **Cutleriales.**
33. Gametes a small active spermatozoid and a nonmotile egg; fronds filiform, tufted, attached by rhizoids. **Tilopteridales.**

34. Sperms biciliate; nonsexual spores absent; gametangia in sunken conceptacles; plants usually flat or flattish, branched, attached below, medium to large in size. (CYCLOSPORÆ). **Fucales.**

34. Sperms with one flagellum, nonsexual spores (tetraspores) nonmotile, reproductive organs external; fronds erect, flat, leaf-like, attached by rhizoids. (DICTYOTEÆ). **Dictyotales.**

35. Nonsexual reproduction by single thallus cells, monospores; trichogyne imperfectly developed; no pits between the thallus cells; plants red or purple, mostly filamentous or sometimes stratose. (MONOSPORÆ). **Bangiales.**

35. Nonsexual reproduction by tetraspores, usually developed in groups of four; trichogyne well developed; carpospores developed on filaments after fertilization; cells of the thallus protoplasmically connected through large pits in the cell walls. (FLORIDEÆ). 36.

36. Sporophores ("gonimoblasts" or branches bearing the carpospores) of the sporocarp on the sexual plant produced directly from the fertilized oogonium; mostly plants with a filiform frond; fresh water or marine. **Nemalionales.**

36. Sporophores produced by auxiliary cells after these conjugate with the fertilized oogonia or their branching processes ("ooblastema"). 37.

37. Sporophores of the sexual plant produced by nearby auxiliary cells; marine plants. 38.

37. Sporophores produced by remote auxiliary cells after these have conjugated with the branched "ooblastema" filaments arising from the fertilized oogonia; fronds filiform, branched, often flattened; mostly marine, but a few fresh water species. **Cryptonemiales.**

38. Sporophores produced by nearby auxiliary cells and growing outward in the plant body; filiform, foliaceous, or massive plants. **Rhodymeniales.**

38. Sporophores produced by nearby auxiliary cells and branching copiously in the surrounding tissues of the plant body; fronds parenchymarous, erect or spreading, branching, cylindrical, flattened, or leaflike. **Gigartinales.**

PHYLA, SUBPHYLA, CLASSES AND SUBCLASSES OF PLANTS.

A general table of the classification of the plant kingdom on a phyletic basis is given below. At present the writer recognizes 50 classes, a class being defined as a group of plants in a subkingdom or division whose members show an evident relationship. A class may also be defined as the largest, definitely determined, monophyletic group in a subkingdom. A phylum consists of one or more classes showing a probable relationship. It might be mentioned that a subkingdom is one of the seven progressive stages into which living plants may be divided, each stage being separated from the next higher by a more or less prominent hiatus.

Phylum I. SCHIZOPHYTA. Fission Plants.
- Class 1. Cyanophyceæ. Blue-green Algæ.
- Class 2. Glaucocysteæ. Higher Blue-green Algæ.
- Class 3. Schizomycetæ. Fission Fungi.
- Class 4. Myxoschizomycetæ. Slime Bacteria.

Phylum II. Myxophyta. Slime Fungi.
- Class 5. Plasmodiophoreæ. Clubroot Fungi.
- Class 6. Acrasieæ.
- Class 7. Myxomycetæ. Slime Molds.
  - Subclasses.
    - a. Ceratiomyxeæ.
    - b. Myxogasteræ.

Phylum III. Zygophyta. Conjugate Algæ.
- Class 8. Diatomeæ. Diatoms. (Subphylum A).
- Class 9. Conjugatæ. Conjugates. (Subphylum B).

Phylum IV. Gonidiophyta. Zoospore Plants.
- Class 10. Autosporæ.
- Class 11. Archemycetæ. Primitive Fungi.
- Class 12. Chlorococceæ. Green-slimes.
- Class 13. Hydrodictyeæ.
- Class 14. Siphonocladeæ. Lower Tube Algæ.
- Class 15. Siphoneæ. Higher Tube Algæ.
- Class 16. Monoblepharideæ.
- Class 17. Conferveæ. Confervas.

Phylum V. Phaeophyta. Brown Algæ.
- Class 18. Phaeosporæ. Kelps.
- Class 19. Cyclosporæ. Rockweeds.
- Class 20. Dictyoteæ.

Phylum VI. Rhodophyta. Red Algæ.
- Class 21. Monosporæ.
- Class 22. Florideæ. Red Seaweeds.

Phylum VII. Charophyta. Stoneworts.
- Class 23. Chareæ.

Phylum VIII. Mycophyta. True Fungi.
- Subphylum A. **Phycomycetæ.** Algal Fungi.
  - Class 24. Zygomycetæ.
  - Class 25. Oomycetæ.
- Subphylum B. **Mycomycetæ.** Higher Fungi.
  - Class 26. Ascomycetæ. Sack Fungi.
    - Subclasses.
      - a. Hemiascæ. Intermediate Sack Fungi.
      - b. Exoascæ.
      - c. Aspergilleæ. Tuber Fungi.
      - d. Discomycetæ. Disk Fungi.
      - e. Pyrenomycetæ. Black Fungi.
      - f. Deuteromycetæ. Imperfect Fungi.
  - Class 27. Laboulbenieæ. Beetle Fungi.
  - Class 28. Teliosporæ. Brand Fungi.
  - Class 29. Basidiomycetæ. Basidium Fungi.
    - Subclasses.
      - a. Protobasidiæ.
      - b. Hymenomycetæ.
      - c. Gasteromycetæ.

Phylum IX. Bryophyta. Mossworts.
- Class 30. Hepaticæ. Liverworts.
- Class 31. Sphagneæ. Bog Mosses.
- Class 32. Schizocarpæ. Granite Mosses.
- Class 33. Musci. True Mosses.
- Class 34. Anthocerotæ. Hornworts.

Phylum X. PTENOPHYTA. Fernworts.
- Class 35. Filices. Ferns.
  - Subclasses.
    - a. Eusporangiatæ. Primitive Ferns.
    - b. Leptosporangiatæ. Modern Ferns.
- Class 36. Hydropteridæ. Water-ferns.
- Class 37. Isoeteæ. Quillworts.

Phylum XI. CALAMOPHYTA. Calamite Plants.
- Class 38. Sphenophylleæ. (Fossil). Wedge-leaf Calamites.
- Class 39. Equiseteæ. Horsetails.
- Class 40. Calamariæ. (Fossil). Calamites.

Phylum XII. LEPIDOPHYTA. Scale-leaf Plants.
- Class 41. Lycopodieæ. Lycopods.
- Class 42. Selaginelleæ. Selaginellas.

Phylum XIII. CYCADOPHYTA. Cycad Plants.
- Class 43. Pteridospermæ (Fossil). Seed Ferns.
- Class 44. Cycadeæ. Cycads.
- Class 45. Cordaiteæ (Fossil). Cordaites.
- Class 46. Ginkgoæ. Maiden-hair-trees.

Phylum XIV. STROBILOPHYTA. Strobilus Plants.
- Class 47. Coniferæ. Conifers.
- Class 48. Gneteæ. Joint-firs.

Phylum XV. ANTHOPHYTA. Flowering Plants.
- Class 49. Monocotylæ. Monocotyls.
  - Subclasses.
    - a. Helobiæ.
    - b. Spadicifloræ.
    - c. Glumifloræ.
    - d. Liliifloræ.
- Class 50. Dicotylæ. Dicotyls.
  - Subclasses.
    - a. Thalamifloræ.
    - b. Centrospermæ.
    - c. Calycifloræ.
    - d. Amentiferæ.
    - e. Myrtifloræ.
    - f. Heteromeræ.
    - g. Tubifloræ.
    - h. Inferæ.

A NEW HYMENOPTEROUS PARASITE UPON ADULT BEETLES.

A. B. GAHAN

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The writer has recently received from Mr. W. V. Balduf, Assistant Entomologist of the Ohio Agricultural Experiment Station and graduate student at Ohio State University, specimens of an interesting parasite which appears to be new to science. This parasite is interesting not only because it attacks a well known garden pest, the cucumber beetle (*Diabrotica vittata*), but it is interesting also structurally and biologically.

The writer is indebted to Mr. Balduf for the following facts regarding its life history: The parasite attacks the adult beetle by mounting on the back of its host and thrusting its ovipositor into the thorax, apparently through one of the sutures near the base of the elytra, and depositing its egg within. The parasite larva feeds internally. In its earlier stages it has a sort of tail like terminal appendage which is lost before maturity. The mature larva escapes from the body of its host either at the junction of head and thorax or of the thorax and abdomen, and although the host is not outwardly defaced, it is killed. The parasite larva undergoes its transformation just below the surface of the soil in a closely woven silken cocoon. Pupation lasts approximately ten days. The parasite is not plentiful, having been found in an average of about one or two beetles per hundred late in the summer and somewhat more commonly in May and June.

In its mode of development the parasite reminds one of the common parasite of lady-bird beetles [*Dinocampus terminalis* Nees], but differs in many important details. It is perhaps more nearly like *Perilitus eleodis* Viereck, but here again there are marked differences in details, such as the manner and place of oviposition, the place of emergence from the host, and the method of pupation.

Following is a description of the adult female parasite:

Superfamily Ichneumonoidea.

Family Braconidæ.

Subfamily Liophroninæ.

Syrrhizus diabroticæ, new species.

This species does not fully agree with the characterization of the genus *Syrrhizus* Foerster, which is said to have the first cubital and first discoidal cells confluent and the notauli entirely effaced. In the present species the first abscissa of cubitus is only partially obsolete and the notauli are not completely effaced, being represented by a short groove at each lateral anterior angle and a deep dimple-like median fovea or depression near the posterior margin of the mesoscutum. It is apparently intermediate between *Syrrhizus* on the one hand and both *Centistes* Haliday and *Leiophron* Nees on the other, but agrees better with the former than with either of the latter. Considering the evident intergradation of the characters cited, it seems more reasonable to place it in *Syrrhizus* than to erect a new genus for it at this time.

Female.—Length 2.2 mm. Head viewed from above transverse, a little more than one and one-half times as broad as long, flattened in front and rounded behind, the occipital carina complete and far below the vertex; frons, vertex, occiput and posterior orbits smooth and polished; viewed from in front the head is very slightly broader than high, subtriangular in outline, convexly rounded above and subtruncate below; inner margins of the eyes nearly parallel, a little divergent below; malar space slightly shorter than the width of mandible at base; face hairy and shining, with a longitudinal swelling medially, and very finely and obscurely punctate laterad of the median ridge; antennæ inserted a little above the middle, 24-jointed, the basal joints approximately three times as long as broad, apical joints about twice as long as broad; mesoscutum perfectly smooth and polished, with the notauli effaced except for a short groove at each lateral anterior angle and a deep median fovea near the posterior margin; disk of scutellum smooth and small, with the transverse groove between it and the mesoscutum very broad and divided in the middle by a single longitudinal carina; lateral face of scutellum strongly rugose; metanotum longitudinally striate; propodeum rugulose except at anterior middle, with a median longitudinal carina on the anterior half and a distinct transverse carina extending completely across the sclerite a little behind the middle, the posterior face with several irregular longitudinal raised lines; spiracles small and round; mesopleura mostly smooth with the groove shallow and more or less weakly foveolate or rugulose; stigma of forewing

broad; first abscissa of radius not half as long as the width of stigma, the second abscissa long and curved, not reaching to the wing apex; metacarpus a little longer than the anterior margin of stigma; basal half of first abscissa of cubitus effaced, the first cubital and first discoidal cells incompletely confluent; cubital vein beyond the intercubitus obsolescent; nervulus postfurcal by nearly its own length; first brachial cell narrowly open at its posterior outer angle; abdomen subequal to the thorax in length, curved downward at apex; first tergite increasing gradually in width from base to apex, longitudinally striate, about twice as broad at apex as at base and a little more than one and one-half times as long as broad at apex; second and following tergites perfectly smooth, the second large and occupying most of the dorsal length of abdomen, tergites beyond the second bent downward; ovipositor curved sharply downward and forward, the ovipositor sheaths broad, narrowed at base and apex and a little shorter than the length of first tergite.

Black; five or six basal joints of antennæ, mandibles, clypeus, palpi, and all legs including their coxæ pale reddish testaceous; face, prothorax and the mesopleura more or less reddish brown to piceous; tarsal claws, and antennæ except base of latter dark brown; wings hyaline, stigma and veins dark brown except medius and submedius which are pale; ovipositor testaceous, its sheaths black.

Male unknown.

Type locality.—Marietta, Ohio.

Type.—Cat. No. 25064, U. S. N. M.

Host.—*Diabrotica vittata* (Fabricius).

Type and three paratype females received from W. V. Balduf, of the Ohio Agricultural Experiment Station, by whom they were reared June 29 and July 2, 1921, from adults of the cucumber beetle.

DESCRIPTIONS OF ALASKAN DIPTERA OF THE FAMILY SYRPHIDÆ.

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All of the species treated in this paper except Sericomia cynocephala were collected by the Katmai Expeditions of the National Geographic Society. Full accounts of the insect collections of these expeditions are being prepared for publication, but as it is desired to refer to some of the species in other papers these descriptions are published in advance of the final report.

Chilosia platycera n. sp.

Male and female shining black. General form of the body elongate and rather slender. Vestiture of the body mostly pale, scutellum with a marginal row of slender black bristles, eyes naked, antennæ yellow, aristæ dark, naked; legs largely black, apex of each femur yellow, tibiæ and tarsi partially yellow; wings pale yellowish hyaline. Length 5–7 mm.

Female: Eyes bare, face and front shining black, front largely pale pilose, but with a few black hairs intermixed, face below the antennæ concave, facial tubercle rather prominent, much nearer the mouth than to the base of the antennæ. Antenna wholly yellow, arista dark, nearly black, bare, third segment unusually large, only slightly longer than wide. Thorax wholly shining black with short, pale, pile rather sparsely distributed. Scutellum with a few slender marginal bristles. Wings pale yellowish hyaline, halteres and squamæ pale, nearly white; legs in large part black, narrow apex of each femur, base and apex of each tibia and second, third and fourth tarsal segments on all the feet yellow. Abdomen shining black all over, pilosity short and pale grayish in color.

Male: Colored like the female, frontal triangle with long black pile, antennæ yellow, third segment decidedly smaller than in the female, pilosity of the body rather long and conspicuous, especially along the side margins of the abdomen, abdomen entirely shining, slenderer than in the other sex.

Female type, Katmai, Alaska, July, 1917. Allotype with the same data. Paratypes, 12 females and 3 males from the same locality taken in June and July, 1917, and one female from Savanosky, Naknek Lake, Alaska, July, 1919. Type in the Ohio State University Collection.

Chilosia robusta n. sp.

Male and female shining black and conspicuously pale pilose all over. Scutellum without bristles which are differentiated from the rather dense covering of pile. Eyes conspicuously long hairy; antenna yellow, arista dark colored, naked; wing yellowish hyaline, somewhat darker along the costa; legs largely black, tibiæ partly yellow. Vestiture over the whole body conspicuously pale yellowish in color, occasionally varying to golden especially in the female. Form robust. Length 9–12 mm.

Female: Front nearly as wide as either eye, shining black, pale pilose; face shining black concave below the antennæ, facial tubercle large and located somewhat nearer the oral margin than the base of the antennæ. Antenna yellow, first two segments partially brown, third segment about as long as broad. Femora black, yellow at extreme apex of each, tibiæ partially yellow, median third or more of each, brown to black, all the tarsi almost wholly dark colored with short golden pile beneath. Wing yellowish hyaline, darkest in costal region of basal half, veins brown, squamæ and halteres pale.

Male: Colored like the female except the body pile tends toward paler in the specimens studied. Abdomen entirely shining as in the female, and somewhat more slender than in that sex.

Differs from lasiopthalma as follows: The face is much less produced in both sexes making the distance between the base of the antennæ and the apex of the facial tubercle much shorter than in lasiopthalma, the pilosity of the eyes is paler and shorter and the wings are less infuscated.

Female type, Kodiak, Alaska, June, 1917. Allotype has the same data. Parotypes, five males and ten females with the same data as the type; seven males and fourteen females, Katmai, Alaska, July, 1917; five males and one female, Snug Harbor, Alaska, June, 1919.

Type in the Ohio State University Collection.

Syrphus attenuatus n. sp.

Male and female. Face yellow, without a black stripe, lower part of front including the insertion of the antennæ yellow, antenna largely reddish, third segment dark above, arista dark, eyes naked, occiput dark in ground color but largely hidden by a covering of yellowish gray pollen. Thorax dull blue black in ground color, scutellum rather bright yellow, entire thorax clothed rather densely with long yellow pile, wings hyaline, costal cells opaque yellowish; abdomen black with three pairs of spots and apex yellow, first pair of spots on second segment somewhat smaller than the other two pairs, triangular, with the long side anterior, outer angle produced over the abdominal margin, second pair of spots on the third segment, oblong, slightly concave anteriorly and convex posteriorly, outer angle very narrowly produced but scarcely

reaching the lateral margin, third pair of spots on the fourth segment similar to those on the third, outer angle produced very narrowly over the margin, posterior margin of fourth segment, anterior and posterior margins of fifth segment and all of sixth segment, yellow. Length, 11 to 13 mm.

Female: Front black on the upper three-fourths, the lower half of the black color yellowish pollinose, less densely so at middle, front black pilose, pilosity continuing below the antennæ on either side next the eyes, much of the face sparsely yellow pilose; all the legs yellow to the bases of the femora, coxæ and trochanters dark, posterior feet pale brownish. All the abdominal spots much attenuated and reaching over the abdominal margins, fifth segment yellow with a curved black band about half the width of the segment.

Male: Vertical triangle black and black pilose, frontal triangle black on superior half and entirely black pilose, pilosity extending much below the antennæ at the sides next the eyes; cheeks blackish beneath the eyes, margin of the mouth behind yellow; legs to the basal fourth of the femora, black, otherwise yellow with the exception of the tibiæ which are partially brown, the hind ones nearly black. Fifth abdominal segment yellow with a very narrow median black marking. Genital segment all yellow.

Male type taken at Savonosky, Naknek Lake, Alaska, July, 1919. Allotype with the same data. Paratypes, ten males and seven females with the same data, a male from the same locality taken in August and a female from Katmai, Alaska, 1917. In the Ohio State University Collection.

The species varies somewhat. In some specimens the abdominal spots are larger and reach the lateral margins plainly and at greater width than in the type. In one specimen the narrow outer margin of the abdomen is all yellow and the black marking on the fifth abdominal segment varies in size and shape in different individuals. Sometimes the hind femora of the male practically entirely yellow. The pair of spots on the fourth abdominal segment is connected occasionally at the anterior inner corners, forming a band which is very deeply notched posteriorly. It is a large robust species, easily separated from others of its size by abdominal markings.

Syrphus curtus n. sp.

Male and female: Eyes naked, cheeks, mouth margin and facial stripe extending upward just over the tubercle, black; remainder of face yellow. Antenna largely black, only the inferior margin of the third segment reddish. Thorax yellow pilose, scutellum pale; wings hyaline. Abdomen with three pairs of yellow spots entirely separated from the margins of the segments, posterior margins of fourth and fifth

segments and anterior outer corners of fifth segment also yellow. Length 8-9 millimeters.

Female: Front black on upper two-thirds, otherwise yellow with the exception of a narrow crescent shaped mark above each antenna which is dark brown, entirely black pilose. Yellow abdominal spots concave anteriorly and convex posteriorly making them somewhat kidney shaped with the outer anterior corner somewhat produced and pointed; the spots on the second segment are smaller and more transverse than the others with the inner ends evenly rounded; legs largely yellow, black to the basal fourth or fifth of the front and middle femora and to a greater extent on the hind femora. Hind tibiæ with dark areas and all the tarsi dark in part.

Male: Vertical triangle black, frontal triangle yellow with black pile. Abdominal spots similar to those of the female, but those on the third and fourth segments quite distinctly larger; legs colored similarly to those of the other sex but black of the femora more extensive, including nearly half of middle and front pairs and two-thirds or more of hind pair.

Female type, Savanoski, Naknek Lake, Alaska, August, 1919. Allotype with the same data. Parotypes, six males and one female from Savanoski, Naknek Lake, Alaska, 1919, and ten females from Katmai, Alaska, 1917. Type in the Ohio State University Collection.

The coloration of the legs is somewhat variable in the species, being darker in general in some specimens, and the black of the femora is more extensive in some specimens than others, especially is this true of the females. The extent of the black on the lower part of the front of the female varies somewhat and the dark crescent-shaped marking above the base of each antenna is more pronounced in some specimens than in others.

Syrphus limatus n. sp.

Male and female shining blue black, face with a wide, shining black stripe, wider than the yellow on either side of it, pointed above and reaching nearly to the base of the antennæ; cheeks shining black, eyes rather sparsely hairy, antennæ black, abdomen with three pairs of narrow spots, first pair small and located near the middle of the second abdominal segment and entirely separated from the margins, second pair near the anterior margin of the third segment very slightly oblique and extending toward the middorsal line but not quite reaching it, inner third of the spot somewhat widened and nearly touching the anterior margin, outer end reaching over the lateral margin in full width; third pair of spots similar to the second, but narrower, located near the anterior margin of the fourth segment; narrow posterior margins of fourth and fifth segments and anterior lateral corners of the fourth segment also yellow. Length 10–11 mm.

Female: Front shining black to the base of the antennæ, black pilose, with an irregular pollinose band reaching from eye to eye above the antennæ, this pollinose band is briefly interrupted at its middle. The yellow on each side of the face unites around the upper end of the black middle part and sends a projection up between the antennæ. Thorax shining black, scutellum dark brown; wing hyaline, stigma opaque black, space between first and second veins slightly infuscated back to the wing base; legs partly black, outer half of front and middle femora and apex of hind femur light brown; all tibiæ in large part brown, tarsi dark, nearly black.

Male: Very near to the female in size and coloration. The hind legs are more extensively black in this sex and the pilosity of the eyes is more pronounced.

Type in the Ohio State University Collection.

This species is somewhat like *creper* and *pauxillus.* It is larger than either and differs in having a much more extensive black marking on the face. The abdominal markings on the third and fourth segments extend over the lateral margins in which respect it agrees with venustus of Europe.

Sericomyia cynocephala n. sp.

Female: Face much produced, so that the distance from the base of the antennæ to the apex of the facial production is nearly twice the distance from the base of the antennæ to the vertex. Face uniformly yellow, lacking the black stripe commonly present in other members of the genus; cheeks from the anterior corner of the eye to the apex of the facial production shining black; front black, sparsely gray pollinose and black pilose; antenna black, third segment about as wide as long and very slightly reddish at base, arista black and long plumose; posterior orbits yellowish pilose. Thorax black in ground color, scutellum pale brown, whole thorax yellowish pilose; wing hyaline, veins mostly pale, stigma yellow, squamæ pale with a pale fringe, ballancers yellow; legs black, tips of femora, less pronounced on the hind pair, and bases of tibiæ yellow. Ground color of abdomen above and below black, segments two, three, and four above each with a pair of oblique elongate yellow spots. All of these spots are widened outwardly and none of them reach any of the margins of their respective segments; spots on the second segment widely interrupted, those on the other segments more narrowly interrupted. Length 14 millimeters.

Female type collected by V. Stefansson at Barrow, Alaska, spring of 1912. Type in the American Museum of Natural History.

This species is distinct from all the species of Sericomyia known to me by the extreme production of the face and the absence of the black facial stripe. In the other species of the genus I have studied the facial tubercle is pronounced, but in cynocephala this tubercle is only feebly indicated.

THE ZOOLOGICAL RECORD

1 Feb., 1922.

The Editor, Ohio Journal of Science:

DEAR SIR: I should be glad if you would draw the attention of your readers to the present position of the Zoological Record.

Owing to the collapse of the International Catalogue of Scientific Literature in connection with which the Record was published from 1906 to 1914 the Zoological Society of London has undertaken to bear the whole financial responsibility for the preparation and printing of the Record.

Owing to the great increase of the cost of printing and to the very meagre support accorded to the Record by Zoologists and Zoological Institutes generally, the financial burden of this undertaking on the Zoological Society is becoming very severe. The cost of printing the Record now amounts to between 1500£ and 2000£ annually and the Society receives back by subscribers and sales less than 25% of this sum; I fear therefore, unless Zoologists are prepared to make greater efforts to support the undertaking, there is a strong possibility that the Council of the Zoological Society may refuse to find this large sum each year.

It appears therefore, to be the duty of every Zoologist to help so far as he is able to support this most invaluable work. All particulars and forms of subscription can be obtained from the Secretary of the Zoological Society, Regents Park, London N. W. 8., but I may mention that the price of the whole volume is now 2 pounds, 10 shillings and the price of the separate parts a proportional smaller sum.

Yours faithfully,

V. L. SCLATER,
(Zoological Society of London).